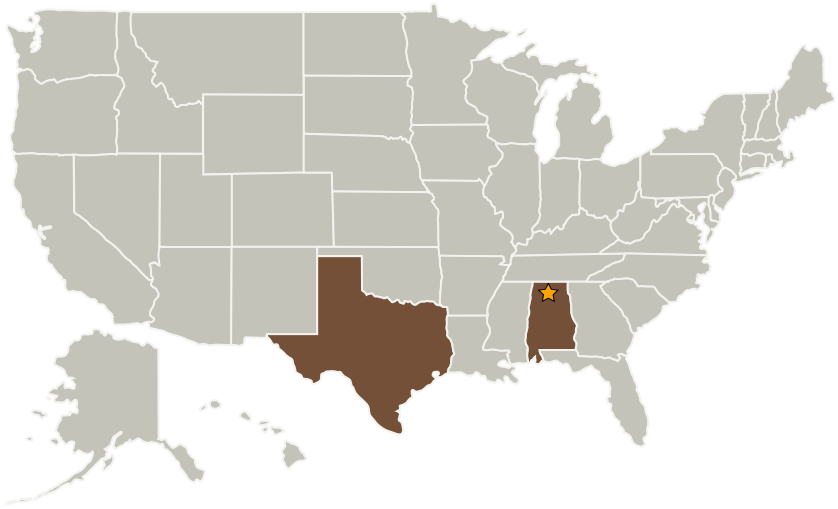
Monitoring Microbes in the Spacecraft Environment by Mass Spectrometry of Ribosomal RNA, Phase I

Completed Technology Project (2006 - 2006)

Project Introduction

The unique stresses in the spacecraft environment including isolation, containment, weightlessness, increased radiation exposure, and enhanced microbial contamination have resulted in a compromise of the immune system in every human or animal that has ever flown in space. Identifying and monitoring the microbial population in the spacecraft environment has therefore been identified as a key maintaining crew health on extended missions. While molecular methods are rapidly supplanting phenotypic identification of micro-organisms, the most successful rapid approaches have employed organism-specific nucleic acid "probes" or primers for PCR amplification. Identification by nucleic acid hybridization therefore implies a priori knowledge (or at least suspicion) of a putative organism. Such assays (including DNA microarrays) are therefore limited in generality by the number of probes or primers on hand. Sequencing of DNA is more general but time consuming and problematic in microgravity. This project describes an "open" or exploratory system with no such limitation which is also superior in speed to DNA sequencing. By leveraging the wealth of publicly available ribosomal RNA sequences for thousands of bacterial strains, and rapid mass spectrometry of novel, mass-modified RNA fragments, the system can identify bacterial species in complex organism mixtures and report their relative abundances. The technology is amenable to high-throughput automated analysis of over 200 samples in less than 2 hours and is compatible with any sample type from which total DNA can be isolated.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
BioTex, Inc.	Supporting Organization	Industry	Houston, Texas

Primary U.S. Work Locations	
Alabama	Texas

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.4 Environmental Monitoring, Safety, and Emergency Response
    - TX06.4.4 Remediation